REMARKS

Applicants request that the Examiner enter all amended claims in order to place this application in condition for allowance or in better form for appeal.

Claim 1 has been amended to require that the liquid product stream exiting the first hydrodesulfurization stage of the instant invention contains less than 500 wppm sulfur. No new matter has been added. Support for this amendment to claim 1 can be found on page 6, second full paragraph of the instant specification.

REJECTION UNDER 35 U.S.C. 102(b)/103(a)

Claims 1-7, 9-16 and 18-19 have been rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as being obvious over United States Patent Number 5,292,428, Harrison et al.("Harrison").

EXAMINER'S POSITION

It is the Examiner's position that Harrison teaches a process wherein hydrocarbon feedstock is passed through two or more hydrodesulfurization zones connected in a series, each zone containing a packed bed of solid catalyst wherein the liquid is passed from a first zone to the next until the final zone. The Examiner further mentions: make-up hydrogen being supplied to the hydrodesulfurization zone other than the first zone; hydrogen-containing gas being recovered from a subsequent hydrodesulfurization zone; target sulfur levels, etc. The Examiner believes that Harrison teaches a process and composition that reasonably appears to be either the same or an obvious variation of the instantly claimed product and composition.

The Examiner also states that when an applicant contends that additional steps or materials in the prior art are excluded by the recitation of "consisting essentially of", the applicant has the burden of showing that the introduction of additional steps or components would materially change the characteristics of applicant's invention. The Examiner then states that applicants' argument set forth in the communication in response to the previous office action that the recycle stream of Harrison would change the material characteristics of the claimed invention lacks merit. The Examiner states that applicants do not limit the amount of sulfur entering the second stage and are read limitations into the claims form the specification.

Further, the Examiner rejects applicants' previous argument with respect to the ratio of hydrogen to feed.

APPLICANTS' POSITION

It is applicants' position that one having ordinary skill in the art and knowledge of Harrison at the time the invention would not have found that Harrison anticipated or obviated the presently claimed invention.

Claim 1, as amended requires that the liquid product stream exiting the first reaction stage have a sulfur level of less than 500 wppm. While the Examiner contends that applicants fail to limit the amount of sulfur entering the second hydrodesulfurization reaction stage, applicants submit that the claims contain limitations that limit the amount of sulfur in the product exiting the first hydrodesulfurization reaction stage. The product exiting the first hydrodesulfurization reaction stage is passed to a separation zone wherein a liquid phase product stream is produced, which liquid phase product stream is

subsequently passed to the second reaction zone. Thus, applicants take the position that it is inherent that the liquid phase product stream entering the second hydrodesulfurization reaction stage contains less than 500 wppm. The liquid product stream from which the liquid phase product is produced, i.e. the liquid product stream exiting the first reaction zone, contains less than 500 wppm sulfur and encounters only a separation zone before entering the second hydrodesulfurization reaction stage. Thus, it is possible that the sulfur level of this stream would decrease, but not increase, because an amount of gaseous sulfur products such as H_2S will be removed through the use of the separation stage, i.e. step (b) of instant claim 1. This is reinforced by Table 1 of the instant invention which lists the amount of sulfur contained in the liquid product stream exiting the first hydrodesulfurization reaction stage and entering the second hydrodesulfurization reaction stage.

Thus, applicants again assert that that the recycle stream of Harrison would materially alter the instant invention. As the volume of the recycle stream increases, so does the amount of sulfur exiting the first reaction zone. Table 3 of Harrison discloses the results of Comparative Example A and Examples 1-6 of Harrison. Line 222 in Table 3 an Figure 3 of Harrison correlates to the liquid product leaving the first hydrodesulfuirization ("HDS") reactor after leaving vessel 218. Vessel 218 is presumably a gas-liquid separation vessel because that is what vessel "9" is referred to in Figure 1 of Harrison, and vessel 218 and 9 appear in the same place after reactor 1 of Harrison. See Fig. 3 of Harrison. Thus, the components of Line 222 listed in Table 3 of Harrison indicate the amount of that component in "ppm" after gas/liquid separation.

Line 247 in Table 3 correlates to the finished product exiting the Harrison process. See Fig. 3 of Harrison. By simply viewing the results contained in Table 3 of Harrison, one can clearly see that as the recycle stream volume increases, so does the amount of sulfur exiting the first stage, listed in col.4 of Table 3. Thus, it is also evident that the amount of sulfur entering the second HDS reaction zone also increases because Line 222 is the feed to the second HDS reaction zone of Harrison.

One can also calculate, as a percentage, the amount of sulfur from the original stream that is passed to the second HDS reaction zone of Harrison. Table 1 of Harrison includes the disclosure that the stream treated in the Harrison examples contains 22,300 wppm S (2.23wt%). By recycling 1 l/hr of liquid from the first hydrodesulfurization zone, the Harrison invention results in 3.2% of the original sulfur contained in the stream exiting the first hydrodesulfurization zone and entering the second hydrodesulfurization zone. Recycling 3 l/hr results in 5.3%, and recycling 7 l/hr results in 7.2 exiting the first hydrodesulfurization zone and entering the second hydrodesulfurization zone.

The desulfurization in the second stage of the instant invention is more efficient because the partial pressure of H_2S in the second reactor is reduced. In other words, the HDS performance of most HDS catalysts is sensitive to the amount of HDS made in the rector, which is a direct function of the amount of sulfur entering the reactor, whether it be H_2S or organic sulfur. Therefore, the instant invention includes the limitation that the amount of sulfur contained in the liquid product exiting the first reaction stage contains less than 500 wppm sulfur, and thus, as previously stated, it is inherent that the liquid

phase product stream entering the second reaction zone have a sulfur content within these limitations.

Simply put, the instant invention is directed at a process that achieves its primary benefit by reducing the H_2S produced in the second hydrodesulfurization reaction stage, and Harrison's invention calls for a recycle stream that clearly acts to the detriment of this benefit. As previously stated the HDS performance of most HDS catalysts is sensitive to the amount of H_2S made in the reactor, which is a direct function of the amount of sulfur entering the reactor, whether it be H_2S or organic sulfur. The recycle steam of Harrison increases the amount of sulfur entering the second stage as evidenced by Table 3 of Harrison. Table 1 of the instant application lists the results of Examples 1-5 of the instant application. The amount of sulfur being passed to the second stage of the instant application is far less than that of Harrison.

Thus, it is applicants' position that the instant invention is not anticipated nor obviated by Harrison. As stated above, the instant invention includes limitations that the liquid product stream exiting the first hydrodesulfurization reaction stage contains less than 500 wppm. In comparing this to Table 3 of Harrison, one can see that the liquid product exiting the first hydrodesulfurization reaction stage of Harrison contains greater than 500 wppm sulfur. Further, the use of a recycle stream in Harrison increases the amount of sulfur contained in the liquid product exiting the first hydrodesulfurization reaction stage of Harrison. It is inherent that the liquid product stream entering the second hydrodesulfurization stage of Harrison contains sulfur levels within the range of those exiting the first hydrodesulfurization stage because Harrison does not remove or

disengage any products between the reaction stages. Thus, by using the recycle stream of Harrison, one having ordinary skill in the art would not have found it obvious to arrive at the instant invention that achieves its primary benefit by reducing the H_2S produced in the second stage, which is a direct function of the amount of sulfur entering the reactor, whether it be H_2S or organic sulfur.

The Examiner also points to Example 1 in Table 3 wherein the recycle stream is "nil". Applicants take the position that this does not anticipate or obviate the present invention either. The stream leaving the first reaction zone in Example 3 of Harrison and entering the second reaction zone contains 714 ppm sulfur. As previously stated, the instant invention requires that this stream contain less than 500 wppm sulfur, well below that contained in the examples of Harrison. Harrison also does not teach that limiting the amount of sulfur contained in the liquid stream exiting the first reaction zone contain less than 500 wppm sulfur, nor does Harrison teach that this would benefit the Harrison process. Instead, Harrison teaches a recycle stream that increases the amount of sulfur contained in the stream exiting the first reaction zone and entering the second reaction zone. As previously stated, increasing the amount of sulfur contained in the stream exiting the first reaction zone and entering the second reaction zone is at odds with the instant invention because the instant invention achieves its primary benefit by reducing the H_2S produced in the second stage, which is a direct function of the amount of sulfur entering the reactor, whether it be H_2S or organic sulfur.

The Examiner is requested to reconsider and withdraw this rejection.

Based on the preceding arguments and amendments, the Examiner is requested to reconsider and withdraw all rejections and pass this application to allowance. The Examiner is encouraged to contact applicants' attorney should the Examiner wish to discuss this application further.

Respectfully submitted:

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